

RESPONSE

U.S. Application No. 10/716,184



Attorney Docket No. Q79839

REMARKS

1. Applicants submit that the product of Daido et al (US 6,291,106) is a substrate for a separator, as can be seen from the description in Example 1, and can thus be used only by being coated with a polymer to form a composite film. In contrast, the porous film of the present invention can itself be used as a separator, and therefore is completely different from the product of Daido in that the product of Daido is a substrate for a separator while the porous film of the present invention is a separator itself.

Further, Applicants submit that the product of Daido is a non-woven fabric sheet consisting of two kinds of fibers and can only be made into a film-like form by being coated with a polymer, as can be seen from the description in Example 1. The porous film of the present invention is different from the product of Daido in that the present porous film is a film itself.

Applicants submit that the gas permeability of the sheet described in Example 1 of Daido is 0.04 sec/100 cc.in², while that of the porous film of the present invention is 0.2-1000 ml/sec. The former is the number of seconds required for 100 cc of air to pass through the sheet, while the latter represents the amount of air passed through the film per unit time and can be converted to 0.1-500 sec/100 cc.in², which is clearly different from the gas permeability value of the sheet of Daido.

The cross-sectional pore laminar coefficient represents how many fine pore layers are piled up in the cross-section of a microporous film. Therefore, this concept cannot be applied to the sheet of Daido in which fibers are piled up. Applicants submit that if remotely applied, it can only be thought that the gaps formed between fibers correspond to pores. However, in Example

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1 of Daido, the size of the fibers employed as the binder is 3 denier and the size of the employed short fibers is 1.25 denier. Applicants submit that from these denier values and the specific gravity of the employed polymer, the diameter of the binder fibers is calculated as 18 μm and that of the short fibers is calculated as 12 μm . In the sheet of Example 1 of Daido, the binder fibers of 18 μm diameter and short fibers of 12 μm diameter are piled up with respect to the sheet thickness of 36 μm and therefore at most three fibers can only be piled up in the sheet cross-section even if the fibers have been squeezed or flattened by calendaring, for example. Then, only two gaps will exist between the three fibers so that the cross-sectional pore laminar coefficient of 2.5 or more as defined in the present invention cannot be attained.

2. According to the description in Shinohara et al (US 6,447,958), column 5, lines 17-20, the battery separator film of Shinohara is not porous where the content of the powder is less than 1 wt%. In contrast, the film of the present invention is porous even though it contains no inorganic additive. Applicants submit that the film of the present invention is different from that of Shinohara in this regard.

Applicants submit that the filler used in Shinohara is an inorganic powder material and is considered to have an approximately spherical shape since Shinohara describes the powder with average particle size (see, column 5, lines 2-3). Applicants note that the average particle size is measured using an electron microscope (see, column 5, lines 7-10), and this method is suitable for measurement of the size of a particulate material. In the present invention, an inorganic whisker, i.e., an inorganic fine fibrous material having a specific aspect ratio is added.

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The filler is added in Shinohara for the purpose of formation of pores and improvement of safety upon melt down, while the inorganic whiskers are added in the present invention for attaining excellent heat resistance and high Young's modulus. Applicants submit that the shapes of the fillers are different between Shinohara and the present invention since the purposes of addition are different.

3. Cieslak et al (US 5,002,843) discloses a separator composed of an m-aramid fiber mat. Applicants submit that the present invention is directed to a porous film which is completely different in shape from the product of Cieslak. Thus, the present invention is clearly distinguished from the art of Shinohara and Cieslak even in combination.

4. Tsutsumi et al (US 5,571,875) discloses a combination of polyimide which is a heat resistant resin and a potassium titanate whisker which is a reinforcing filler, but does not disclose the combination of m-aramid and a whisker. Thus, Applicants submit that the present invention is clearly distinguished from the art of Shinohara, Cieslak and Tsutsumi even in combination.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Respectfully submitted,



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